No. VIII.

Experiments made on the Poison of the Rattlesnake; in which the Powers of the HIERACEUM VENOSUM, *as a Specific, were tested; together with some Anatomical Observations on this Animal. By Richard Harlan, M.D.—Read March 7th*, 1828.

IN offering the following observations, it is not my intention, or desire, to add another specific to the numerous antidotes to the poison of the Rattlesnake, already before the public. Most of these remedies have proved, on trial, to be either destitute of active properties, or altogether unworthy of serious consideration. I shall therefore briefly notice a few of the most celebrated.

The most ancient, at least, if not the most renowned, is the *volatile alkali*, a remedy prescribed by European practitioners more than a century ago, not only as an antidote for the poison of the viper, but against the effects of the bite of venomous animals in general*. The Abbé Fontana, about the middle of last century, published a work on the poison of the viper, to which we may refer for many curious experiments on the nature of this poison†.

* Vid. Dict. des Sciences Medicales, vol. xxxiv. p. 309; article Morsure.

† The following among other conclusions are offered by Fontana; the viper alluded to is the "Coluber berus" of Linn. "1. The bite of the viper is not pois-

There are few authorities of the present day inclined to place much faith in the volatile alkali as an antidote for the specific effects of the bite of the viper; but as the constitutional symptoms, produced by the bite of venomous reptiles, are generally adynamic in their nature, this remedy, together with other diffusible stimulants, is calculated to counteract this state of the system, and may prove very serviceable in supporting the vital powers, and thus suspend the fatal operation of the poison. To this conclusion I have been led by experiment.

The next remedy for accidents of this nature worthy of notice, is the "*Prenanthis serpentaria*" of Pursh. This plant is held in high esteem by the inhabitants of Virginia, as a remedy for the bite of the Rattlesnake, and is known to them by the familiar name of "*Lionsfoot.*" Pursh states that he had an opportunity of being a witness to the efficacy of this plant. A man living in Cove mountains, near the Sweet-springs, was bit in the foot by a Mockeson, [Cenchris Mockeson? Dandin,] a species of snake considered the most dangerous. An inflammation and swelling of the whole leg took place immediately; but by taking the milky juice of this plant, boiled in milk, inwardly, and applying to the wound the steeped leaves, which were frequently changed, he was cured in a few days. The plant is frequently confounded with another species of the same genus, from which it is important to distinguish it; this last the inhabitants name "*false Lionsfoot.*" Gronovius, in his Flora, page 113, mentions Dr Witt's *snake-root* under *P. autumnalis*, or Willdenow's "*rubicunda*," as a remedy for the bite of the Rattlesnake, which shews that he had information of the use made of this plant, though he did not know the genuine species.—Vid. Pursh's "Flora Americæ Septentrionalis," p. 499.

onous to its own body, or to that of its own species. 2. The venom is not equally destructive to all animals. 3. The poison is neither acid, alkaline, nor saltish. 4. It has no positive taste, and taken into the mouth does not cause the tongue to swell. 5. It is not inflammable. 6. Mixed with water it sinks to the bottom; when shaken it renders the water turbid and whitish."—Vide Fontana—"Ricerché fisichè sopra il veleno della vipera."

The remedy which next claims our attention, has been considered as of sufficient importance to demand legislative enactment. It appears that some years ago, the State Assembly of South Carolina purchased from a Negro, for an annuity of one hundred pounds for life and his freedom, the secret of his cure for the bite of the Rattlesnake. This proved to be the "*Alisma plantago*," or water-plantain. Many of the members are said to have witnessed the efficacy of the remedy in the person of the Negro, who stripped himself naked and jumped into a tub, containing many of these venomous snakes, and received numerous wounds. He cured himself by swallowing one tablespoonful of the expressed juice of the Alisma plantago, and repeated the dose at intervals, until the effects of the poison were counteracted. An essay was published on this subject in the sixth volume of the Technical Repository of 1824, by C. Whitlaw, Esq.*, who states that the common plantain has been used by mistake, to which error he attributes all the reputed failures.

My friend Major N. A. Ware informs me that in Florida and Alabama, a species of *Pedicularia*, or "Louse-plant" is of considerable repute as an antidote to poisons of this nature. Sweet oil has also been famous as a specific in similar cases. A number of experiments were performed by a viper catcher before the Royal Society of London, in order to prove its efficacy, some account of which was published in the early numbers of the New York Medical Repository.

But passing over this remedy and many others of a similar nature, we come to the consideration of the plant which was

* The following extract from Mr Whitlaw's Essay is probably sufficient to destroy his authority altogether among medical men,—though the above statement concerning the experiments I believe to be historical fact.

"The specific action of the poison appears to be chiefly confined to the muscles: after the infliction of the bite, powerful muscular contractions take place over the whole body, the muscles are highly inflamed, a coldness and corrugation of the skin surround the part which was bitten, and violent spasms resembling tetanus supervene followed by mortification. A friend of mine at Savannah died in consequence of being bitten by a snake in the hand; when they took hold of his arm to place him in the coffin, *the arm came off at the shoulder joint.*"—Vid Technical Repos. vol. iv. p. 258.

the immediate object of my own experiments. It must be here repeated that the *Hieraceum venosum* is not offered as a specific cure for the bite of the Rattlesnake: much further observation is requisite to establish its claims to such high virtues. It is proposed to continue the experiments on the commencement of the approaching season, but in the mean while it was thought advisable to publish the present account as the first of a series, in as much as several facts have been elicited, which are considered very important by those who witnessed the experiments.

November 2d, 1827. In company with a number of professional gentlemen, I visited the collection of living Rattlesnakes* exhibiting by Messrs Elnsworth and Murray. The reptiles, to the number of 150, were all taken by the proprietors in their native county of Susquehanna, Pennsylvania, during the current months of August and September. The proprietors profess to be in possession of an infallible remedy for the cure of the symptoms resulting from the bite of the Rattlesnake; they display the utmost confidence, and are on terms of intimate familiarity with every individual of the collection; they take them in their hands and fold them around their necks,—open the mouth of the snake, and expose his fangs to the view of the visitors, &c. In order to satisfy ourselves that there existed no trick or deception in the case, and to prove that the bite of these animals, in their present state of subjection, is really mortal, two living animals were exposed to be bitten, both of whom died within the space of eight minutes. The first received a severe wound on the breast, the snake fastening his fangs in the flesh; immediately the eyes of the animal (a young cat) were observed to change their expression, lacking lustre, and appearing like the eyes of an intoxicated person. In three minutes after the infliction of the wound, involuntary discharges per anum occurred; in six minutes urine was also discharged. The pu-

* Crotalus durissus, Linn.

pils of the eyes were dilated, and in eight minutes convulsions and death supervened.

A narcotic or sedative effect of the poison was an early symptom, and this soon degenerated into insensibility.

In the second experiment, the kitten was introduced into the box among the snakes, and received wounds from several; one of the proprietors, Mr Elnsworth, having introduced his hand into the box among the reptiles with a view of irritating them, received two distinct wounds on the back of the hand, and which were observed to be inflicted by different individual snakes; the wounds bled slightly. Mr E. displayed no uneasiness, but loitered about the room and continued the exhibition for some time, and then took an opportunity to retire for a few minutes, and returned entirely out of danger; two small punctured wounds alone remained visible; the bleeding had ceased, and the slight tumefaction which had commenced around the wound had entirely disappeared. No marks of suction were discovered, nor were any precautions taken, in presence of the visitors, after the infliction of the wound, with the exception of the application of a ligature around the wrist.

In fine, that the proprietors are actually convinced that they possess some means to render the poison of the Rattlesnake innocuous, would seem to be proved by the experiments above stated, as well as by the perfect composure and unlimited confidence of the man, when fairly wounded by the poisonous animals, which at the same time were inflicting mortal wounds on the subjects of the experiments.

They stated to the company that the specific was of Indian renown, that a decoction of the plant was administered internally, and that, for a moderate compensation, the secret would be disclosed.

Accordingly, on the 15th of December, 1827, a number of gentlemen*, including several eminent individuals of the

* The following is a list of the names of those gentlemen who liberally contributed towards paying the amount demanded by the proprietors for the disclosure of

medical profession, convened at my office for the purpose of witnessing experiments made with the poison of the *Rattlesnake*, (*Crotalus durissus*, Linn.) Some days previous, a number of the most lively and vicious among them were separated, and permitted to drink; abstinence both from food and water having been strictly enjoined previously, during the period of their confinement, from an idea of the proprietors, that abstinence, particularly as respects water, is calcuated to render the poison less destructive.

Experiment 1.

It was decided that Mr Elnsworth, who had offered himself as the subject of the experiment, should be first bitten, and afterwards that the same snake should be made to demonstrate its poisonous powers upon a puppy.

A large active female snake was taken from the box and placed upon a table in a warm room. At 11 h. 20 m. A. M. the man received a bite from the irritated snake on the index finger of the left hand, about half an inch from the metacarpal bone; the wound resembled a minute incision, or briar scratch about one fifth of an inch in length; one fang only appears to have been projected, the animal striking with one or both fangs at pleasure; a little blood exuded. Pulse, just before the bite was received, 104 per minute; but it was observed to vary during the experiments to such a degree as to prevent any correct inference to be expected from that source.

11 h. 40 m. He says the wound smarts a little, but no signs of a poisonous wound are as yet exhibited.

their "Secret," most of whom, with several others, were present at the experiments:—

Drs Chapman, Harris, Meigs, Emerson, Mitchell, Wetherill, J. R. Barton, Pennock, Captain Bazil Hall, R. N., Messrs S. Wetherill, J. P. Wetherill, and W. Hembel. Notes were taken by several of the gentlemen, and the present statements result from a comparison of them all.

After the lapse of nearly an hour from the commencement of the experiment, no symptom denoting the action of the poison occurring, Elnsworth exposed the same hand to a large active male snake. As in the first instance, considerable irritation of the animal was requisite to force him to strike, and at

12 h. 15 m. He received a second wound from a single fang on the back of his hand, directly over a prominent venous branch. A large drop of transparent, yellowish, and glairy fluid was spread over and around the wound, which was doubtless ejected from the poison sack. A little very dark blood slowly exuded from the wound.

12 h. 31 m. Slight swelling is observable immediately around the second bite.

12 h. 48 m. Elnsworth again exposed his hand to the female snake, and received two additional punctures simultaneously, one from each fang, on the lower extremity of the metacarpal bone of the ring-finger. As in the first instance, neither of these wounds displayed symptoms of the specific effects of the poison; the *second bite* therefore, or that received from the male snake, will alone be the subject of further observations in this experiment.

1 o'clock, P. M. The swelling around the second bite has increased considerably, the tumefaction extending up and down along the course of the vein, about an inch and a half in length, and half that size in breadth, the greatest length of the tumefaction being below the wound. The man now complained of pain and numbness along the course of the lymphatic vessels on the inner part of the fore-arm.

1 h. 25 m. Pulse natural, symptoms last described somewhat increased; swelling unattended with symptoms of inflammation.

1 h. 30 m. Although the man is perfectly willing to permit the symptoms to proceed further, several of the witnesses expressed their unwillingness to bear the responsibility of the consequences; he was therefore permitted to have recourse to his remedy, and he immediately swallowed a few ounces

of the decoction of the root, and appeared indifferent about the external application of the same to the wound. He stated that the original stock of the vegetable being exhausted, and the season too far advanced to enable him to obtain more at present, he would be under the necessity of applying portions of the flesh of one of the reptiles (just decapitated for the purpose of another experiment) to the wound.

2 h. 30 m. He has held the bloody portion of the snake to his wound incessantly, from which all the swelling has subsided, together with all uneasy sensations, from his hand and arm.

4 o'clock, P. M. The man Elnsworth has remained constantly in the room under my inspection. His dinner was offered to him, but he had little disposition for food; says his stomach is a little sick, probably the effects of the medicine. No tumefaction or other symptoms remain; the wounds resemble slight scratches without any appearance of inflammation. The vein in which the bite took effect presents a peculiar appearance, being for the distance of an inch between the valves above and below the wound quite empty. Directly above the valve the vein is unusually prominent, and the pressure, from the application of the flesh, has been removed for more than an hour. It is scarcely necessary to remark that the application of portions of the snake to the wound, which the man appeared to think very important, could exert no other influence than might have been obtained from the application of the recent flesh of any other animal.

The root and leaf of the "specific" were produced and exposed to the inspection of an able botanist, Dr Charles Pickering, who identified it with the *Hieraceum venosum*, or Hawk-weed, Adder's-tongue, Poor Robin's plantain, Rattlesnake weed, &c.—a common weed in the dry open woodlands*. The same plant is noticed by Schoepf as a remedy for the bite of the Rattlesnake.

* Vid. Florula Cestrica, by W. Darlington. M.D., p. 84.

Experiment 2.

11 h. 31 m. A pup about three or four weeks old was bitten by the same female snake which had previously bitten Elnsworth in the first experiment: both fangs took effect, and the two wounds were about one inch and a quarter apart.

11 h. 34 m. Pup urinates.

11 h. 36 m. Cries and staggers.

11 h. 37 m. Belly tense in the vicinity of the wound, and apparently painful; the wound presents an ecchymosis, being tumid and of a dark colour.

11 h. 39 m. Pup lies on its side, and continues its plaintive cries, also emits some froth from the mouth. The ecchymosis increases rapidly, and a pale bloody humour exudes from the wounds.

11 h. 51 m. The animal is quiet and fanting.

12 o'clock, merid. Appears vertiginous, turning round and resting on its extended fore feet; staggering and resting on its side, and turning upon its back. These symptoms continued with little alteration until

4 o'clock, When the animal died, having previously exhibited some stertorous breathing, but without the occurrence of convulsions.

Dissection.

I examined the body fifteen minutes after death in presence of Drs Morton, Meigs, Emerson, &c. On raising the skin of the abdomen we observed an extensive extravasation of blood, not coagulated, in the cellular tissue over the whole front of the belly. The colour of the parts exposed to the specific action of the poison was a dark red, and the whole appearance in the vicinity of the wound might be aptly compared to that occasioned by an extensive and violent contusion.

The abdomen, being laid open, displayed the abdominal

reflections of the peritoneum nearly in the same condition, being very red, and appearing as if soaked in blood. A similar appearance, to a considerable extent, prevailed in the peritoneal coat of the stomach and intestines, the veins of which were congested. The internal coats of the stomach and intestines were natural in appearance. Urinary bladder was empty. No coagulated blood was observed in any of the vessels throughout the system. Thorax presented no remarkable deviation from a natural state.

Cranium.—On raising the skull and dura mater, an extensive dark patch, formed apparently by extravasation or congestion, was observed under the arachnoid membrane lying over the cerebral lobes, and extending down in a slight degree between the convolutions. The substance of the brain and spinal marrow appeared natural. The muscular system was rather pale.

It will probably be remarked, that the specific action of the poison appears to have expended its deleterious influence on the *cellular* tissue in this animal: the usual phenomena which characterize death from poisons, such as non-coagulation of the blood, extravasations, &c. were remarkably well developed.

Experiment 3.

A full grown cock, having the feathers removed from over the pectoral muscles, was exposed to be bitten by a Rattlesnake, and at

12 o'clock, merid. Received two slight wounds from both fangs at the same time; each wound was covered with drops of a transparent fluid ejected from the poison bag.

12 h. 3 m. The bitten part assumed the appearance of a dark-purple ecchymosis, and the skin in the immediate vicinity of the punctures was puckered or corrugated.

12 h. 45 m. The parts over the wounds are slightly tumid, and present a black or gangrenous appearance, and are

moistened by a yellowish ichor which exudes from the wounds.

The animal finally recovered without having experienced any constitutional affection. It should be here remarked, however, that the punctures did not appear to have penetrated the skin thoroughly.

Experiment 4.

A black puppy, a few weeks old, received three bites between 12 h. 18 m. and 12 h. 23 m. The last and most severe bite was over the left eye.

12 h. 27 m. Apparently drowsy.

12 h. 40 m. Symptoms progressing slowly. And at

4 o'clock, P. M. the swelling over the eye, vertigo, and general uneasiness, appear to have attained their height. On the day following the animal had recovered without the interference of art.

Experiment 5.

4 o'clock, P. M. A stout pup was inoculated with the poison, expressed from the poison bag of a living snake, on the left side of the abdomen.

4 h. 15 m. Local symptoms are evident, and constitutional effects are beginning to be manifested.

5 o'clock, P. M. Symptoms much increased: the animal cries with pain and uneasiness; changes its posture frequently; moves with a tottering and irregular gait, sometimes lying on its breast with the fore-feet extended: these symptoms were occasionally interrupted with drowsiness, and finally the animal went into a deep sleep.

9 o'clock, P. M. The pup commenced licking his wound, the swelling of which, from the ecchymosis, had so increased as to hang down like a large hernia.

The succeeding day this animal also recovered, no symptom remaining except a slight tenderness in the part where the inoculation had been performed. Had the "*specific*" been administered in this case, the cure would doubtless have been attributed to its operation.

Experiment 6.

Poison was squeezed out of the sack of a living snake, and being placed on a piece of meat, was given to a pup to eat: it produced no effect, local or constitutional, upon the animal.

Anatomical Observations, &c.

In all venomous snakes there is an opening of considerable size situate between the eye and nostril, which penetrates in the direction of the poison apparatus, at the base of the fang; the use of this opening, in the economy of the animal, as far as I can learn, has never been discovered; it has no direct communication with the cavity containing the poison, but is connected with the lachrymal passages, so successfully investigated by Jules Cloquet*. On a careful examination of this portion of the anatomy of the Crotalus, I have invariably found at the bottom of this cavity an exceedingly delicate transparent membrane, extending over the osseous cavity in the bone at the base of the fang. This membrane, whilst it intercepts any direct communication between the sack and external canal, might at the same time permit the action of the atmosphere on the fluid contained in the sack, to take place through it, and thus to change its chemical properties. This sack communicates with the oculo-palpebral cavity, formed between the eyelid and conjunctiva. The poison of

* Vid. Memoire sur l'Existence et la Disposition des Voies Lachrymales dans les Serpens.

the living Crotalus, tested in numerous instances with litmus paper, &c. invariably displayed acid properties*.

General Remarks.

In conclusion it appears, that of the number of reptiles exhibited, some possessed the venomous faculty to a considerable degree, in others the poison was less active, and in some it had entirely disappeared, and in the latter the poison sack was found, on dissection, entirely empty.

These circumstances are readily explained when we are aware that the reptiles have remained in captivity without food for more than three months, during a cold season of the year, and, until within a few days of the experiments, deprived of water. It is more than probable that very little poison would be secreted during a state of perfect abstinence, and that of less activity than when produced under ordinary circumstances. Hence the same reptiles whose bite occasioned the death of an animal in eight minutes, when the experiments were performed in September, required five hours in order to produce fatal results at the present period. The operation of the poison on the animal system also varied. In September, when the animals died early after the infliction of the wound, death was preceded by convulsions, which was not the case in the present instance; but the animal appeared to suffer more pain, and finally fell into a state of stupidity, which continued for several hours, when death was produced by the slow operation of the poison on the system. On dissection the usual appearances produced by such poisons

* Similar observations relative to the acidity of this poison were long ago made by Dr Brickell of Savannah, who, speaking of the external application of the solution of caustic ley to the bite of the Rattlesnake, states "I was led to this by a chemical examination of the poison of the *Crotalus horridus*, which shewed an acid to be one of its constituents."—Vid. New York Medical Repository, vol. viii. p. 441.

on the organic structure, were manifest; congestions, exudation of blood throughout the system, together with the non-coagulation of this fluid, were among the more obvious results. The cavities of the heart were empty, and fluid blood was observed in the large veins.

Two of the Rattlesnakes were decapitated, and the heads being placed with the jaws expanded against the abdomen of a living rabbit, they were observed to bite repeatedly with the desperation of expiring nature, forcing their fangs into the flesh their whole length; but in these the poison bag appeared to have been emptied previously, by repeated efforts of the animal to bite, and on dissection were found nearly void. After decapitation it was curious to observe the motions of the body, which were continued from association; the cut extremity of the trunk, when an injury was inflicted near the tail, was thrown towards the offending body, as if with the intention of inflicting a wound; this experiment was repeated frequently. The heart torn from the body continued its contractions for ten or twelve hours.

Of all the animals bitten in these experiments, one only died, though all were more or less affected by the poison. Although the wound which was inflicted on Mr Elnsworth was attended with the usual *local* effects, there is no proof that the poison would have proved mortal without the use of the remedy, in as much as obvious local effects were observed in some of the animals that finally recovered without the interference of art. Though at the same time it will be remembered that the first animal experimented on died from the poison of the same snake which had previously inflicted a wound on the man.

As regards any moral influence being exerted over these animals by the proprietors, which enables them to handle the snakes without the fear of being wounded,—one of the proprietors, Mr Murray, subsequently confessed that no such influence existed; but that their knowledge of the habits of the Rattlesnake enabled them to handle them with impunity. Thus they are aware that the snake can strike only after

certain preparation of the body; they assume an offensive attitude previously to striking a blow, and they seldom or never make an effort to strike when once secured by the hand.

The Abbé Fontana has remarked that the poison of the viper is not fatal to its own body, or to that of its own species when bitten; the contrary of this position is stated on respectable authority to be the case as regards the Crotalus—a result that might have been anticipated from the well known fact that Rattlesnakes, congregated together in any number, never inflict a wound on each other.

Among the most remarkable peculiarities observed in the economy of this animal is its power of abstinence. An individual lived more than two years in the Philadelphia Museum, totally deprived of food. Others in the same institution have been observed united for a considerable time in the act of coition, and subsequently to bring forth young in a living state. In one instance I have witnessed a female with fourteen young at one birth, which is far from being to the same degree prolific as some of the oviparous Colubers.

In the present stage of the investigation, had I occasion to treat a wound inflicted by a poisonous reptile, my faith in the *Hieraceum venosum*, as a cure, is not such as to induce me to resort to its employment, to the exclusion of the less equivocal means of suction, pressure, or ligature. Some very interesting experiments, which establish the superiority of the last mentioned methods, have recently been made by C. W. Pennock, M.D., and will be published in the American Journal of the Medical Sciences for May 1828.